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BELL LABORATORIES

SUPPORTING INFORMATION

CATEGORY	NUMBER
MAINTENANCE REFERENCE MANUAL	PK-1C900

COMMON SYSTEMS

3A CC

COMMAND MANUAL

AT&TCo PROV

PK-1C901-01-A1

37 PAGES

E-8430 (1-71) PRINTED IN U.S.A.

1. INTRODUCTION

1.01 THE SECTIONS OF THIS SPECIFICATION CONSTITUTE THE COMMAND MANUAL FOR THE 3ACC. ALL THE 3ACC COMMANDS ARE INCLUDED, TOGETHER WITH A DETAILED DISCRIPTION OF EACH, AND GENERAL INSTRUCTIONS FOR THEIR USE IN PROGRAMMING.

2. DESCRIPTION

2.01 THIS SPECIFICITION DESCRIBES ALL THE COMMANDS IN THE 3ACC INSTRUCTION SET SO THAT THE PROGRAMMER MAY SELECT THE INSTRUCTIONS BEST SUITED TO THE TASK BEING PROGRAMMED. THE MANUAL CONTAINS A DETAILED DESCRIPTION OF EACH INSTRUCTION, AND THE CONDITIONS THAT MUST BE SET UP PRIOR TO THEIR USE. THE APPROXIMATE TIME INTERVAL REQUIRED TO EXECUTE EACH COMMAND IS SUPPLIED FOR EACH.

4. GENERAL NOTES AND EXPLANATIONS

4.01 EACH COMMAND IS ILLUSTRATED AS IT APPEARS IN THE FULL PROGRAM STORE WORD. CERTAIN COMMANDS ARE DOUBLE WORD COMMANDS AND ARE SO DEPICTED.
4.02 IN THE ILLUSTRATION OF THE PROGRAM STORE WORD, PH AND PL STAND FOR THE PARITY HIGH AND PARITY LOW BITS PESPECTIVELY.
4.03 IN THE ILLUSTRATION OF THE PROGRAM STORE WORD, BA STANDS FOR BRANCH ALLOWED. IF A BRANCH IS MADE TO A PROGRAM STOREWORD, THAT WORD MUST HAVE THE BA BIT SET EQUAL TO ONE OR A BRANCH ERROR WILL BE GENERATED. EXTRACTION OF DATA IS NOT CONSIDERED TO BE A BRANCH.

4.04 A MICROSTORE CYCLE IS DEFINED AS 150 NSEC.

4.05 THE OPERATION CODES THAT ARE SHOWN IN THE PROGRAM STORE WORD ILLUSTRATIONS ARE IN HEXADECMIAL.

4.06 OP CODE MNEMONICS BEGINNING WITH:

A	INDICATES	ADD
B	INDICATES	BRANCH
C	INDICATES	COMPARE OR COMPLEMENT
EX	INDICATES	EXCHANGE
I	INDICATES	INSERT
L	INDICATES	LOAD
M	INDICATES	MAINTENANCE
N	INDICATES	AND
O	INDICATES	INCLUSIVE OR
RL	INDICATES	ROTATE LEFT
RR	INDICATES	ROTATE RIGHT
S	INDICATES	SET OR SUBTRACT
ST	INDICATES	STORE
T	INDICATES	TEST
X	INDICATES	EXCLUSIVE OR
Z	INDICATES	ZERO

4.07 SYMBOLS USED IN COMMAND DESCRIPTIONS:

*	AND
!	OR
~	NOT
%Y	CONTENTS OF WORD IN MEMORY
CF	CONDITION FLIP-FLOP

4.08 OPERAND SYMBOLS:

Rx OR Ry	ANY OF THE 16 GENERAL REGISTERS (R15-R0) WITHIN THE JACC. SEE PAGE C1.
Rs	ANY OF THE 16 SPECIAL REGISTERS WITHIN THE JACC. SEE PAGE C11 AND TABLE BELOW.

AI	==>	ADDRESS INPUT REGISTER - ADDRESS MATCH FUNCTION
AM	==>	ADDRESS MASK REGISTER - ADDRESS MATCH FUNCTION
DB	==>	DISPLAY BUFFER - PANEL DISPLAY
DI	==>	DATA INPUT REGISTER - DATA MATCH FUNCTION
DM	==>	DATA MASK REGISTER - DATA MATCH FUNCTION
EW	==>	ERROR REGISTER
IM	==>	INTERRUPT MASK REGISTER
IS	==>	INTERRUPT SET REGISTER (READ ONLY)
MCHB	==>	MAINTENANCE CHANNEL BUFFER REGISTER
MCHTR	==>	MAINTENANCE CHANNEL TRANSMIT/RECEIVE REGISTER (LOAD ONLY)
MMSR	==>	MAIN MEMORY STATUS REGISTER
MS	==>	MAINTENANCE STATES REGISTER
PA	==>	PROGRAM ADDRESS REGISTER
SAR	==>	STORE ADDRESS REGISTER
SS	==>	SYSTEM STATUS REGISTER
TI	==>	TIMER (READ ONLY)

PA= PA0 OR R12	GENERAL REGISTER ADDRESS PAIR OF R12 AND R13 USED TO CONTAIN A 20-BIT ADDRESS (BITS 3-0 OF R12 AND BITS 15-0 OF R13)
PA= PA1 OR R14	GENERAL REGISTER ADDRESS PAIR OF R14 AND R15 USED TO CONTAIN A 20-BIT ADDRESS (BITS 3-0 OF R14 AND BITS 15-0 OF R15)

B	BIT POSITION
I	IMMEDIATE DATA
M	MASK
N	4-BIT NUMBER (IMMEDIATE DATA OR INDEX)
OFFSET	8-BIT INDEX NUMBER
X	LOW 8 BITS OF AN ADDRESS
Y	MEMORY ADDRESS LOCATION

INSTRUCTION	TENGTH		PAGE NUMBER
AI Rx,I	D	ADD 16 BITS OF IMMEDIATE DATA, I, TO Rx	17
AN Rx,N	S	ADD 4 BITS OF IMMEDIATE DATA, N, TO Rx	17
AR Rx,Ry	S	ADD Ry TO Rx AND STORE THE RESULT IN Rx	17
AIS Y	D	ADD 1 TO THE CONTENTS OF MEMORY AT LOCATION Y	17
B Y	S	BRANCH TO LOCATION Y	12
BC Y	S	BRANCH ON CONDITION TO LOCATION Y	12
BCL Y	D	BRANCH LONG ON CONDITION TO LOCATION Y	13
BL Y	D	BRANCH LONG TO LOCATION Y	12
BNC Y	S	BRANCH ON NOT CONDITION TO LOCATION Y	13
BNCL Y	D	BRANCH LONG ON NOT CONDITION TO LOCATION Y	13
BPAY Rx	S	BRANCH TO LOCATION PA INDEXED BY Rx	14
BP N(PA)	S	BRANCH TO LOCATION RA INDEXED BY N	12
BRX Fx(PA)	S	BRANCH TO LOCATION PA INDEXED BY Rx	14
BRA Y	D	BRANCH TO LOCATION Y AND SAVE ADDRESS	14
BSAI X	S	BRANCH AND SAVE ADDRESS INDIRECT	14
BTRA	S	BRANCH TO SAVED ADDRESS	15
BTSAG	S	GET REGISTERS 2 THROUGH 15 AND BRANCH TO SAVED ADDRESS	15
BTSAGN N	S	GET REGISTERS, LOAD RETURN CODE, AND BRANCH TO SAVED ADDRESS	16
BTSAM N	S	LOAD RETURN CODE AND BRANCH TO SAVED ADDRESS	15
BX Rx,Y	D	BRANCH ON INDEX NOT ZERO TO LOCATION Y	13
CI Rx,I	D	COMPARE Rx TO 16-BITS OF IMMEDIATE DATA, I	21
CIPM Rx,I,N,M	D	COMPARE 8 BITS OF Rx ROTATED BY N WITH IMMEDIATE DATA AND MASK	21
COFL-N(PA)	S	COMPLEMENT WRITE THE OFF-LINE STORE AT LOCATION RA INDEXED BY N	30
COFLP Rx(PA)	S	COMPLEMENT WRITE THE OFF-LINE STORE AT LOCATION RA INDEXED BY Rx	30
COM Rx[,Ry]	S	COMPLEMENT Rx[-Ry] AND STORE IN Rx	19
CONL N(PA)	S	COMPLEMENT WRITE THE ON-LINE STORE AT LOCATION RA INDEXED BY N	29
CONLP Rx(PA)	S	COMPLEMENT WRITE THE ON-LINE STORE AT LOCATION RA INDEXED BY Rx	29
CR Rx,Ry	S	COMPARE Ry TO Rx	20
CRM Rx,Ry,M	D	COMPARE Ry TO Rx UNDER 16 BIT IMMEDIATE MASK	21
EXR Rx,Ry	S	EXCHANGE THE CONTENTS OF Rx WITH THE CONTENTS OF Ry	9
FLR Rx,Ry	S	FIND LOW ZERO IN Rx AND RECORD ITS POSITION IN Ry	22
GA	S	GET REGISTERS 2 THROUGH 15 FROM WORDS 2 THROUGH 15 OF HOLD-GET AREA	8
GN Rx,N	S	GET Rx FROM WORD N OF HOLD-GET AREA	8
HA	S	HOLD REGISTERS 2 THROUGH 15 IN WORDS 2 THROUGH 15 OF HOLD-GET AREA	7
HALT	S	HALT THE CENTRAL CONTROL	32
HN Rx,N	S	HOLD Rx IN WORD N OF HOLD-GET AREA	8
ICP Rx,N	S	INSERT CP IN BIT N OF Rx	25
IPM Rx,Ry,M	D	INSERT Ry INTO Rx UNDER IMMEDIATE MASK, M	9
L Rx,N(RA)	S	LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION RA INDEXED BY N	2
LA Rx,N(RA)	S	LOAD Rx FROM MEMORY AT LOCATION RA INDEXED BY N AND UPDATE RA	2
LAL Rx,Y,RA	D	LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION Y AND SET RA TO Y	2
LAX Rx,Ry(RA)	S	LOAD Rx FROM MEMORY AT LOCATION IN INDEXED BY Ry AND UPDATE RA	3
LI Rx,I	D	LOAD Rx WITH 16 BITS OF IMMEDIATE DATA, I	3
LL Rx,Y	D	LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION Y	1
LN Rx,N	S	LOAD Rx WITH 4 BITS OF IMMEDIATE DATA, N	3
LR Rx,Ry	S	LOAD Rx WITH THE CONTENTS OF Ry	9
LRM Rx,Ry,M	D	LOAD Rx WITH THE CONTENTS OF Ry UNDER IMMEDIATE MASK, M	9
LRS Rx,Rs	S	LOAD Rx WITH THE CONTENTS OF Rs	10
LSP Rx,Rs	S	LOAD Rs WITH THE CONTENTS OF Rx	10
LX Rx,Ry(RA)	S	LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION RA INDEXED BY Ry	2
MI	D	MICRO INTERPRET	32
MIS	D	SINGLE CYCLE MICRO INTERPRET	32
MSTF N(PA)	D	MAINTENANCE STORE FUNCTION USING REGISTER 0 AT LOCATION RA INDEXED BY N	31
MSTFX Rx(PA)	D	MAINTENANCE STORE FUNCTION USING REGISTER 0 AT LOCATION RA INDEXED BY Rx	31
NI Rx,I	S	AND 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx	19
NOP	S	NO OPERATION	32
NR Rx,Ry	S	AND Ry TO Rx AND STORE IN Rx	19
OI Rx,I	D	INCLUSIVE OR 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx	19
OR Rx,Ry	S	INCLUSIVE OR Ry TO Rx AND STORE IN Rx	20
PACK Rs	S	PACKS GENERAL REGISTERS 2 AND 3 INTO 20 BIT SPECIAL REGISTER Rs	11
PIE	S	PROGRAM INTERRUPT END	16
PL Rx,Ry	S	ROTATE Rx LEFT AN AMOUNT DETERMINED BY THE LOW 4 BITS OF Ry	21
RLN Rx,N	S	ROTATE Rx LEFT BY N BIT POSITIONS	22
RR Rx,Ry	S	ROTATE Rx RIGHT AN AMOUNT DETERMINED BY THE LOW 4 BITS OF Ry	22
RRN Rx,N	S	ROTATE Rx RIGHT BY N BIT POSITIONS	22
SBN Rx,B	S	SET BIT B IN Rx	23
SBR Rx,Ry	S	SET BIT IN Rx DETERMINED BY THE LOW 4 BITS OF Ry	23
SBS N(RA),B	S	SET BIT B IN MEMORY WORD AT LOCATION DETERMINED BY ADDING N TO RA	23
SCP	S	SET THE COMPUTION-FLOP	23
SI Rx,I	D	SUBTRACT 16 BITS OF IMMEDIATE DATA, I, FROM Rx	18
SIO	S	SEND I/O MESSAGE OVER CHANNEL AND SUBCHANNEL DEFINED IN R9	27
SMIC	S	SEND MAINTENANCE I/O MESSAGE OVER CHANNEL AND SUBCHANNEL DEFINED IN R9	27
SN Rx,N	S	SUBTRACT 4 BITS OF IMMEDIATE DATA, N, FROM Rx	18
SOP	S	SET OF CODE FIL BIT	23
SP Rx,Ry	S	SUBTRACT Ry FROM Rx AND STORE THE RESULT IN Rx	18
ST Rx,N(PA)	S	STORE Rx IN MEMORY AT LOCATION PA INDEXED BY N	4
STA Rx,N(PA)	S	STORE Rx IN MEMORY AT LOCATION RA INDEXED BY N AND UPDATE PA	4
STAF N(RA)	D	STORE ACCESS FUNCTION USING REGISTER 0 AT LOCATION RA INDEXED BY N	5
STAFX Rx(PA)	D	STORE ACCESS FUNCTION USING REGISTER 0 AT LOCATION RA INDEXED BY Rx	6
STAL Rx,Y,RA	D	STORE Rx IN MEMORY AT LOCATION Y AND SET RA TO Y	4
STAX Rx,Ry(PA)	S	STORE Rx IN MEMORY AT LOCATION PA INDEXED BY Ry AND UPDATE PA	5
STL Rx,Y	D	STORE RI IN MEMORY AT LOCATION Y	4

INSTRUCTION	LENGTH		PAGE NUMBER
STM Rx,N(RA),M	D	INSERT Rx UNDER MASK INTO MEMORY AT LOCATION RA INDEXED BY M	6
STVM Rx,N(RA)	S	INSERT Rx UNDER VARIABLE MASK INTO MEMORY AT LOCATION RA INDEXED BY N	6
STX Rx,Ry(RA)	S	STORE Rx IN MEMORY AT LOCATION RA INDEXED BY Ry	5
TBN Rx,B	S	TEST BIT B IN Rx	26
TBR Rx,Ry	S	TEST BIT IN Rx DETERMINED BY LOW 4 BITS OF Ry	26
TBR N(RA),B	S	TEST BIT B IN MEMORY WORD AT LOCATION DETERMINED BY ADDING N TO RA	26
TCC1	S	TEST CENTRAL CONTROL 1	26
TCH	S	TEST THE MAIN I/O CHANNEL DEFINED IN R9 FOR THE IDLE STATE	28
TIO	S	TEST FOR I/O MESSAGE IN CHANNEL DEFINED IN R9	27
TMIO	S	TEST FOR MAINTENANCE I/O MESSAGE IN CHANNEL DEFINED IN R9	28
TPPH Rx	S	TEST GENERAL REGISTER PARITY HIGH	25
TPPL Rx	S	TEST GENERAL REGISTER PARITY LOW	25
TSPPH Rs	S	TEST SPECIAL REGISTER PARITY HIGH	25
TSPPL Rs	S	TEST SPECIAL REGISTER PARITY LOW	25
TZ Rx	S	TEST Rx FOR ALL ZEROS	22
UNPF Rs	S	UNPACKS 20 BIT SPECIAL REGISTER Rs TO GENERAL REGISTERS 2 AND 3	11
XI Rx,I	D	EXCLUSIVE OR 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx	20
XR Rx,Ry	S	EXCLUSIVE OR Ry TO Rx AND STORE IN Rx	20
ZBN Rx,B	S	ZERO BIT B IN Rx	24
ZBR Rx,Ry	S	ZERO BIT IN Rx DETERMINED BY THE LOW 4 BITS OF Ry	24
ZBS N(RA),B	S	ZERO BIT B IN MEMORY WORD AT LOCATION DETERMINED BY ADDING N TO RA	24
ZCF	S	ZERO THE CONDITION-FLOP	24
ZIO	S	ICLE THE MAIN I/O CHANNEL DEFINED IN R9	28
ZOP	S	ZERO OP CODE FIL BIT	24
ZR Rx	S	ZERO Rx	9

DEFINITION OF ADDRESSABLE 16-BIT GENERAL PURPOSE REGISTERS

0	REGISTER 0
1	REGISTER 1
2	REGISTER 2
3	REGISTER 3
4	REGISTER 4
5	REGISTER 5
6	REGISTER 6
7	REGISTER 7
8	REGISTER 8
9	REGISTER 9 ALSO USED FOR INPUT/OUTPUT
10	REGISTER 10 ALSO USED FOR INPUT/OUTPUT
11	REGISTER 11 ALSO USED FOR INPUT/OUTPUT
12	REGISTER 12 ALSO USED FOR MEMORY ADDRESSING
13	REGISTER 13 ALSO USED FOR MEMORY ADDRESSING
14	REGISTER 14 ALSO USED FOR MEMORY ADDRESSING
15	REGISTER 15 ALSO USED FOR MEMORY ADDRESSING

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

LL Rx,Y LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION Y

PH	PL	BA	OP CODE 31	Rx	BITS(19-16) OF Y
PH	PL	BITS(15-0) OF Y			

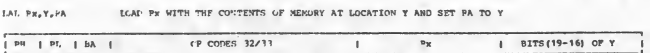
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION Y.

2. MEMORY AT LOCATION Y IS UNCHANGED.

APPROXIMATE EXECUTION TIME 3.75 MICROSECONDS

LAI Rx,Y,RA LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION Y AND SET RA TO Y



1. LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION Y AND SET RA TO Y.

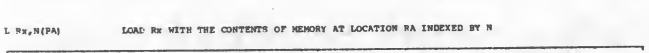
2. Rx SHOULD NOT BE EQUAL TO EITHER MEMBER OF THE RA REGISTER PAIR.

3. MEMORY AT LOCATION Y IS UNCHANGED.

NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
BITS(15-8) OF GENERAL REGISTER 12/14 ARE NOT CHANGED BY THIS INSTRUCTION.
SEE NOTE CONCERNING PA ON PAGE B2.

APPROXIMATE EXECUTION TIME 3.90 MICROSECONDS

L Rx,N(RA) LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION RA INDEXED BY N

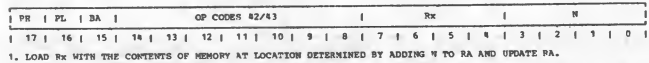


1. LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION DETERMINED BY ADDING N TO RA.

NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
SEE NOTE CONCERNING PA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.55 MICROSECONDS

LA Rx,N(RA) LOAD Rx FROM MEMORY AT LOCATION RA INDEXED BY N AND UPDATE RA



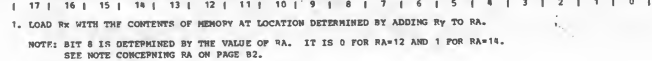
1. LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION DETERMINED BY ADDING N TO RA AND UPDATE RA.

2. Rx SHOULD NOT BE EQUAL TO EITHER MEMBER OF THE RA REGISTER PAIR.

NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
BITS(15-8) OF GENERAL REGISTER 12/14 ARE NOT CHANGED BY THIS INSTRUCTION.
SEE NOTE CONCERNING PA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.55 MICROSECONDS

LX Rx,Ry(RA) LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION RA INDEXED BY Ry



1. LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION DETERMINED BY ADDING Ry TO RA.

NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.55 MICROSECONDS

LAX Rx,Ry(PA) LOAD Rx FROM MEMORY AT LOCATION RA INDEXED BY Ry AND UPDATE RA

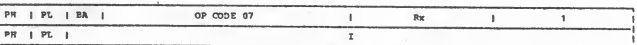
1. LOAD Rx WITH THE CONTENTS OF MEMORY AT LOCATION DETERMINED BY ADDING Ry TO RA AND UPDATE RA.

2. Rx SHOULD NOT BE EQUAL TO EITHER MEMBER OF THE RA REGISTER PAIR.

NOTE: BIT 0 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=13.
BITS(15-4) OF GENERAL REGISTER 12/13 ARE NOT CHANGED BY THIS INSTRUCTION.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.55 MICROSECONDS

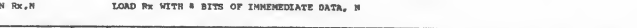
LI Rx,I LOAD Rx WITH 16 BITS OF IMMEDIATE DATA, I



1. LOAD Rx WITH I.

APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

LN Rx,N LOAD Rx WITH 8 BITS OF IMMEDIATE DATA, N



1. ZERO BITS(15-8) OF Rx.

2. LOAD Rx BITS(3-0) WITH N.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

REGISTER TO MEMORY OPERATIONS

STL Rx,Y STORE RI IN MEMORY AT LOCATION Y

PN	PL	BA	OP CODE 39	Rx	BITS(19-16) OF Y
PN	PL	BITS(15-0) OF Y			

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. STORE Rx IN MEMORY AT LOCATION Y.

2. Rx IS UNCHANGED.

APPROXIMATE EXECUTION TIME 3.75 MICROSECONDS

STAL Rx,Y,RA STORE Rx IN MEMORY AT LOCATION Y AND SET RA TO Y

PN	PL	BA	OP CODES 3A/3B	Rx	BITS(19-16) OF Y
PN	PL	BITS(15-0) OF Y			

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. STORE Rx IN MEMORY AT LOCATION Y AND SET RA TO Y.

2. Rx SHOULD NOT BE EQUAL TO EITHER MEMBER OF THE RA REGISTER PAIR.

3. Rx IS UNCHANGED.

NOTE: BIT 0 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
BITS(15-8) OF GENERAL REGISTER 12/14 ARE NOT CHANGED BY THIS INSTRUCTION.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 3.05 MICROSECONDS

ST Rx,N(RA) STORE Rx IN MEMORY AT LOCATION RA INDEXED BY N

PN	PL	BA	OP CODES 48/49	Rx	N

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. STORE Rx AT LOCATION DETERMINED BY ADDING N TO RA.

2. Rx IS UNCHANGED.

NOTE: BIT 0 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

STA Rx,N(RA) STORE Rx IN MEMORY AT LOCATION RA INDEXED BY N AND UPDATE RA

PN	PL	BA	OP CODES 4A/4B	Rx	N

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. STORE Rx AT LOCATION DETERMINED BY ADDING N TO RA AND UPDATE RA.

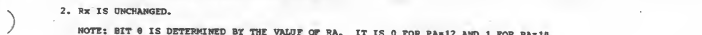
2. Rx SHOULD NOT BE EQUAL TO EITHER MEMBER OF THE RA REGISTER PAIR.

3. Rx IS UNCHANGED.

NOTE: BIT 0 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
BITS(15-8) OF GENERAL REGISTER 12/14 ARE NOT CHANGED BY THIS INSTRUCTION.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

STX Rx,Ry(RA) STORE Rx IN MEMORY AT LOCATION RA INDEXED BY Ry



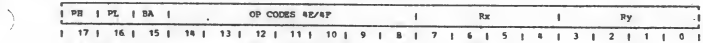
1. STORE Rx AT LOCATION DETERMINED BY ADDING Ry TO RA.

2. Rx IS UNCHANGED.

NOTE: BIT 0 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

STAX Rx,Ry(RA) STORE Rx IN MEMORY AT LOCATION RA INDEXED BY Ry AND UPDATE RA



1. STORE Rx AT LOCATION DETERMINED BY ADDING Ry TO RA.

2. Rx SHOULD NOT BE EQUAL TO EITHER MEMBER OF THE RA REGISTER PAIR.

3. Rx IS UNCHANGED.

NOTE: BIT 0 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
BITS(15-4) OF GENERAL REGISTER 12/14 ARE NOT CHANGED BY THIS INSTRUCTION.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

STAP N(PA) STORE ACCESS FUNCTION USING REGISTER 0 AT LOCATION RA INDEXED BY N

1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING N TO PA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. LOAD THE MAIN MEMORY STATUS REGISTER FROM THE SECOND WORD OF THIS INSTRUCTION.
THE ISOLATE BITS ARE LEFT AS THEY WERE ON ENTRY.

4. PERFORM THE INDICATED READ/WRITE OPERATION USING REGISTER 0 AS DESTINATION/SOURCE FOR THE DATA.

5. PARITY IS CORRECTED ON THE DATA RECEIVED FROM THE STORE BEFORE IT IS PLACED IN REGISTER 0.

6. ZERO THE CF.

7. IF A STORE ERROR C OCCURS:
A. THE CF IS SET EQUAL TO ONE.
B. THE ER IS CLEARED.

8. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

9. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
IF THE INSTRUCTION TIMES OUT,REGISTER 0 IS SET TO ALL ONES.

NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY,IT WILL BE SUPPLIED BY SYSTEM MACROS.
REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

NOTE: BIT 0 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 9.45 MICROSECONDS.

STAFX Rx(PA) STORE ACCESS FUNCTION USING REGISTER 0 AT LOCATION PA INDEXED BY Rx

| PH | PL | BA | OP CODE 7C | 2/3 | Rx |

| PH | PL | BEC0 | CW0 | BDSR1 | PDSP0 | ISO1 | ISO0 | UPD1 | UPD0 | IDL1 | IDL0 | RW1 | RW0 | MM21 | MM20 | MM11 | MM10 |

| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING Rx TO RA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. LOAD THE MAIN MEMORY STATUS REGISTER FROM THE SECOND WORD OF THIS INSTRUCTION.
   THE ISOLATE BITS ARE LEFT AS THEY WERE ON ENTRY.

4. PERFORM THE INDICATED READ/WRITE OPERATION USING REGISTER 0 AS DESTINATION/SOURCE FOR THE DATA.

5. PARITY IS COMPUTED ON THE DATA RECEIVED FROM THE STORE BEFORE IT IS PLACED IN REGISTER 0.

6. ZERO THE CF.

7. IF A STORE ERROR OCCURS:
   A. THE CF IS SET EQUAL TO ONE.
   B. THE ER IS CLEARED.

8. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

9. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
   IF THE INSTRUCTION TIMES OUT, REGISTER 0 IS SET TO ALL ONES.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY SYSTEM MACROS.
         REFER TO 3ACC COMMON SYSTEM PROGRAMMER'S GUIDE X-74292.
   NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
         SEE NOTE CONCERNING PA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 9.30 MICROSECONDS.

STM Rx,N(PA),N INSERT Rx UNDER MASK INTO MEMORY AT LOCATION PA INDEXED BY N

| PH | PL | BA | OP CODES 04/05 | Rx | N |

| PH | PL | MASK |

| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

1. ADD N TO PA TO DETERMINE LOCATION OF WORD WY.

2. LOAD GENERAL REGISTER 0 WITH THE CONTENTS OF WORD WY.

3. (WY • ¬MASK) | (Rx • MASK) ==> WY

   NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
         SEE NOTE CONCERNING PA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 5.40 MICROSECONDS

STVM Rx,N(PA) INSERT Rx UNDER VARIABLE MASK INTO MEMORY AT LOCATION PA INDEXED BY N

| PH | PL | BA | OP CODES 66/67 | Rx | N |

| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

1. OBTAIN MASK FROM THE CONTENTS OF REGISTER 0.

2. ADD N TO PA TO DETERMINE LOCATION OF WORD WY.

3. LOAD GENERAL REGISTER 0 WITH THE CONTENTS OF WORD WY.

4. (WY • ¬MASK) | (Rx • MASK) ==> WY

   NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
         SEE NOTE CONCERNING PA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 5.55 MICROSECONDS

LAYOUT OF 16 WORD HOLD-GET AREA

PN	PL	OP	WORDS 0 AND 1 ARE RESERVED FOR RETURN ADDRESS	BITS (19-16) OF RA
PN	PL		BITS(15-0) OF RETURN ADDRESS	
PN	PL		WORD 2 RESERVED FOR REGISTER 2 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 3 RESERVED FOR REGISTER 3 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 4 RESERVED FOR REGISTER 4 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 5 RESERVED FOR REGISTER 5 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 6 RESERVED FOR REGISTER 6 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 7 RESERVED FOR REGISTER 7 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 8 RESERVED FOR REGISTER 8 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 9 RESERVED FOR REGISTER 9 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 10 RESERVED FOR REGISTER 10 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 11 RESERVED FOR REGISTER 11 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 12 RESERVED FOR REGISTER 12 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 13 RESERVED FOR REGISTER 13 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 14 RESERVED FOR REGISTER 14 WHEN HELD BY HOLD ALL INSTRUCTION	
PN	PL		WORD 15 RESERVED FOR REGISTER 15 WHEN HELD BY HOLD ALL INSTRUCTION	

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

NOTE: WORDS 0 AND 1 ARE HELD BY BSA INSTRUCTIONS AND INTERRUPTS.

HA HOLD REGISTERS 2 THROUGH 15 IN WORDS 2 THROUGH 15 OF HOLD-GET AREA

PN	PL	BA	OP CODE 73	1	0

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. STORE EACH REGISTER IN ITS ASSOCIATED WORD OF THE HOLD-GET AREA.

2. REGISTERS STORED ARE UNCHANGED.

NOTE: WORDS 0 AND 1 OF THE HOLD-GET AREA ARE RESERVED FOR RETURN ADDRESS.

APPROXIMATE EXECUTION TIME 28.55 MICROSECONDS

PH Px,N HOLD Px IN WORD N OF HOLD-GET AREA

1. STORE Px IN WORD N OF HOLD-GET AREA.
2. Px IS UNCHANGED.

APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

GA GET REGISTERS 2 THROUGH 15 FROM WORDS 2 THROUGH 15 OF HOLD-GET AREA

1. LOAD EACH REGISTER FROM THE ASSOCIATED WORD OF THE HOLD-GET AREA.

NOTE: WORDS 0 AND 1 OF THE HOLD-GET AREA ARE RESERVED FOR RETURN ADDRESS.

APPROXIMATE EXECUTION TIME 26.55 MICROSECONDS

GN Px,N GET Px FROM WORD N OF HOLD-GET AREA

1. LOAD Px FROM WORD N OF HOLD-GET AREA.
2. WORD N IS UNCHANGED.

APPROXIMATE EXECUTION TIME 2.55 MICROSECONDS

REGISTER TO REGISTER OPERATIONS

LR Rx,Ry LOAD Rx WITH THE CONTENTS OF Ry

1. LOAD Rx WITH THE CONTENTS OF Ry.

2. Ry IS UNCHANGED.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

LRM Rx,Ry,M LOAD Rx WITH THE CONTENTS OF Ry UNDER IMMEDIATE MASK, M

1. Ry • MASK ==> Rx

2. Ry IS UNCHANGED.

APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

IRM Rx,Ry,M INSERT Ry INTO Rx UNDER IMMEDIATE MASK, M

1. (Ry • MASK) | (Rx • ¬MASK) ==> Rx.

2. Ry IS UNCHANGED.

APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

EXR Rx,Ry EXCHANGE THE CONTENTS OF Rx WITH THE CONTENTS OF Ry

1. EXCHANGE THE CONTENTS OF Rx WITH THE CONTENTS OF Ry.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

ZR Rx ZERO Rx

1. ZERO REGISTER Rx. THE CP IS UNCHANGED.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

SPECIAL REGISTER OPEPATIONS

THE FOLLOWING TABLE DEFINES THOSE REGISTERS WHICH ARE ACCESSED WITH THE SPECIAL REGISTER INSTRUCTIONS

Rs	TO FIELD FUNCTION		FROM FIELD FUNCTION	
0	GB ==> MCHTP	22 BIT PATH	II ==> GB	18 BIT PATH PL=0,PE=0
1	GB ==> SAP	22 BIT PATH	SAR ==> GB	22 BIT PATH
2	GB ==> PA	22 BIT PATH	PA ==> GB	22 BIT PATH
3	GB ==> MCHB	22 BIT PATH	MCHB ==> GB	22 BIT PATH
4	UNASSIGNED		MMSP ==> GB	20 BIT PATH PL=0,PM=1
5	GB ==> AK	22 BIT PATH	AK ==> GB	22 BIT PATH
6	GB ==> AI	22 BIT PATH	AI ==> GB	22 BIT PATH
7	GB ==> DK	18 BIT PATH	DK ==> GB	18 BIT PATH
8	GB ==> DI	18 BIT PATH	DI ==> GB	18 BIT PATH
9	GB ==> DB	22 BIT PATH	DB ==> GB	22 BIT PATH
10	GB ==> ER	22 BIT PATH	ER ==> GB	22 BIT PATH
11	GB ==> DB IF DISPLAY BIT IN SS IS 1	22 BIT PATH	UNASSIGNED	
12	GB ==> IM	18 BIT PATH	IM ==> GB	18 BIT PATH
13	GB ==> SS_S	A 1 SETS SS	IS ==> GB	18 BIT PATH
14	GB ==> MS	18 BIT PATH	MS ==> GB	18 BIT PATH
15	GB ==> SS_R	A 1 RESETS SS	SS ==> GB	22 BIT PATH PL=-CC,PM=CC

NOTE: THE 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292 SHOULD BE CAREFULLY STUDIED BEFORE USING ANY OF THE SPECIAL INSTRUCTIONS.

LPS Rx,Ps LOAD Rx WITH THE CONTENTS OF Rs

1. LOAD Rx WITH THE CONTENTS OF Rs
   WHERE Rx IS ONE OF THE GENERAL PURPOSE REGISTERS
   AND Rs IS ONE OF THE 16 BIT SPECIAL REGISTERS

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

LSR Rs,Rx LOAD Rs WITH THE CONTENTS OF Rx

1. LOAD Rs WITH THE CONTENTS OF Rx
   WHERE Rx IS ONE OF THE GENERAL PURPOSE REGISTERS
   AND Rs IS ONE OF THE 16 BIT SPECIAL REGISTERS

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

PACK Rs — PACKS GENERAL REGISTERS 2 AND 3 INTO 20 BIT SPECIAL REGISTER Rs

PH	PL	BA	OP CODE 14	Rs	0
17 16	15	14	13 12 11 10	9 8 7 6 5 4	3 2 1 0

1. GENERAL REGISTER 2 BITS(3-0) ==> Rs BITS(19-16)

2. GENERAL REGISTER 3 BITS(15-0) ==> Rs BITS(15-0)

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

UNPK Rs — UNPACKS 20 BIT SPECIAL REGISTER Rs TO GENERAL REGISTERS 2 AND 3

PH	PL	BA	OP CODE 15	0	Rs
17 16	15	14	13 12 11 10	9 8 7 6 5 4	3 2 1 0

1. Rs(19-16) ==> GENERAL REGISTER 2 BITS(3-0)

2. Rs(15-0) ==> GENERAL REGISTER 3 BITS(15-0)

3. GENERAL REGISTER 2 BITS(15-4) ARE SET TO ZERO BY THIS INSTRUCTION.

NOTE: IT IS NOT NECESSARY TO SUPPRESS THE GATING BUS PARITY CHECK WHEN USING THIS INSTRUCTION ON A SPECIAL REGISTER THAT MAY NOT HAVE CORRECT PARITY.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

BRANCH OPERATIONS

B Y BRANCH TO LOCATION Y

1. BRANCH TO LOCATION Y WHICH IS DETERMINED BY ADDING OFFSET TO THE PA.

   NOTE: BIT 8 IS DETERMINED BY THE SIGN OF THE OFFSET. IT IS 0 FOR POSITIVE OFFSET AND 1 FOR NEGATIVE OFFSET.

   APPROXIMATE EXECUTION TIME 1.80 MICROSECONDS

BR N(PA) BRANCH TO LOCATION PA INDEXED BY N

1. BRANCH TO LOCATION Y WHICH IS DETERMINED BY ADDING N TO PA.
2. THIS INSTRUCTION IS ONLY CAPABLE OF FORWARD BRANCHES.

   NOTE: BIT 4 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR PA=12 AND 1 FOR PA=14.
   SEE NOTE CONCERNING PA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

BL Y BRANCH LONG TO LOCATION Y

1. BRANCH TO LOCATION Y.

   APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

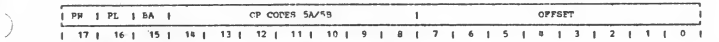
BC Y BRANCH ON CONDITION TO LOCATION Y

1. IF THE CF IS EQUAL TO:
   A. ZERO, DO NOT BRANCH AND EXECUTE THE NEXT SEQUENTIAL INSTRUCTION.
   B. ONE, BRANCH TO LOCATION Y WHICH IS DETERMINED BY ADDING OFFSET TO THE PA.

   NOTE: BIT 8 IS DETERMINED BY THE SIGN OF THE OFFSET. IT IS 0 FOR POSITIVE OFFSET AND 1 FOR NEGATIVE OFFSET.

   APPROXIMATE EXECUTION TIME 1.95 MICROSECONDS FOR CF=1 AND 1.50 MICROSECONDS FOR CF=0

BNC Y BRANCH ON NOT CONDITION TO LOCATION Y



1. IF THE CF IS EQUAL TO:
   A. ZERO, BRANCH TO LOCATION Y WHICH IS DETERMINED BY ADDING OFFSET TO THE PA.
   B. ONE, DO NOT BRANCH AND EXECUTE THE NEXT SEQUENTIAL INSTRUCTION.

   NOTE: BIT 8 IS DETERMINED BY THE SIGN OF THE OFFSET. IT IS 0 FOR POSITIVE OFFSET AND 1 FOR NEGATIVE OFFSET.

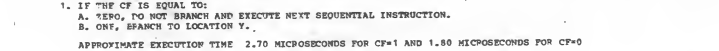
   APPROXIMATE EXECUTION TIME 1.50 MICROSECONDS FOR CF=1 AND 1.95 MICROSECONDS FOR CF=0

BCL Y BRANCH LONG ON CONDITION TO LOCATION Y

1. IF THE CF IS EQUAL TO:
   A. ZERO, DO NOT BRANCH AND EXECUTE NEXT SEQUENTIAL INSTRUCTION.
   B. ONE, BRANCH TO LOCATION Y.

   APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS FOR CF=1 AND 1.80 MICROSECONDS FOR CF=0

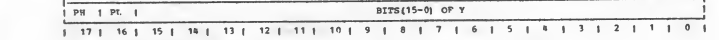
BNCL Y BRANCH LONG ON NOT CONDITION TO LOCATION Y



1. IF THE CF IS EQUAL TO:
   A. ZERO, BRANCH TO LOCATION Y.
   B. ONE, DO NOT BRANCH AND EXECUTE THE NEXT SEQUENTIAL INSTRUCTION.

   APPROXIMATE EXECUTION TIME 1.80 MICROSECONDS FOR CF=1 AND 2.70 MICROSECONDS FOR CF=0

BX Rx,Y BRANCH ON INDEX NOT ZERO TO LOCATION Y



1. IF THE CONTENTS OF Rx IS NOT EQUAL TO ZERO, DECREMENT Rx BY 1 AND BRANCH TO LOCATION Y.

2. IF THE CONTENTS OF Rx IS EQUAL TO ZERO, EXECUTE THE NEXT SEQUENTIAL INSTRUCTION.

   APPROXIMATE EXECUTION TIME 2.55 MICROSECONDS FOR Rx=0 AND 2.70 MICROSECONDS FOR Rx¬=0

BPX Rx(PA) BRANCH TO LOCATION PA INDEXED BY Rx

PR	PL	BA	OP CODE 55	2/3	Rx
17	16	15	14 13 12 11 10 9 8	7	6 5 4 3 2 1 0

1. BRANCH TO LOCATION Y, WHICH IS DETERMINED BY ADDING THE CONTENTS OF Rx TO PA.

2. THIS INSTRUCTION IS ONLY CAPABLE OF FORWARD INDEXING.

NOTE: BIT 4 IS DETERMINED BY THE VALUE OF PA. IT IS 0 FOR PA=12 AND 1 FOR PA=14.
SEE NOTE CONCERNING PA ON PAGE B2.

APPROXIMATE EXECUTION TIME 2.55 MICROSECONDS

BPAX Rx BRANCH TO LOCATION PA INDEXED BY Rx

PR	PL	BA	OP CODE 5C	0	Rx
17	16	15	14 13 12 11 10 9 8	7	6 5 4 3 2 1 0

1. BRANCH TO LOCATION Y, WHICH IS DETERMINED BY ADDING THE CONTENTS OF Rx TO PA+1 (PROGRAM ADDRESS REGISTER +1.)
2. THIS INSTRUCTION IS ONLY CAPABLE OF FORWARD INDEXING.

APPROXIMATE EXECUTION TIME 1.65 MICROSECONDS

BSA Y BRANCH TO LOCATION Y AND SAVE ADDRESS

PR	PL	BA	OP CODE 3F	1	BITS(19-16) OF Y
PR	PL	BITS(15-0) OF Y			
17	16	15	14 13 12 11 10 9 8	7	6 5 4 3 2 1 0

1. DECREMENT THE HOLD-GET COUNTER BY 16 AND STORE THE RETURN ADDRESS IN WORDS 0 AND 1 OF THE HOLD-GET AREA. BITS 4-15 OF HOLD-GET AREA WORD 0 ARE ZEROED.

2. TRANSFER TO LOCATION Y.

NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO. REFER TO 3ACC COMMON SYSTEM PROGRAMMER'S GUIDE X-74292.

APPROXIMATE EXECUTION TIME 6.15 MICROSECONDS

BSAI X BRANCH AND SAVE ADDRESS INDIRECT

PR	PL	BA	OP CODE 76	X
17	16	15	14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

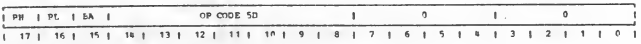
1. DECREMENT THE HOLD-GET COUNTER BY 16 AND STORE THE RETURN ADDRESS IN WORDS 0 AND 1 OF THE HOLD-GET AREA. BITS 4-15 OF HOLD-GET AREA WORD 0 ARE ZEROED.

2. BRANCH TO LOCATION X*2.

NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO. REFER TO 3ACC COMMON SYSTEM PROGRAMMER'S GUIDE X-74292.

APPROXIMATE EXECUTION TIME 5.70 MICROSECONDS

BTSA BRANCH TO SAVED ADDRESS



1. SET THE CF EQUAL TO:
   A. ONE, IF REGISTER 0 IS ZERO.
   B. ZERO, IF REGISTER 0 IS NONZERO.

2. SET THE OP CODE FIL BIT EQUAL TO BIT 15 IN WORD 0 OF THE HOLD-GET AREA.

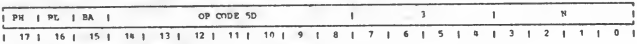
3. BRANCH TO THE RETURN ADDRESS WHICH IS STORED IN WORDS 0 AND 1 OF THE HOLD-GET AREA.

4. ADD 16 TO THE HOLD-GET COUNTER.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

   APPROXIMATE EXECUTION TIME 4.95 MICROSECONDS

BTSAN N LOAD RETURN CODE AND BRANCH TO SAVED ADDRESS



1. LOAD THE RETURN CODE N INTO BITS (3-0) OF REGISTER 0.
   BITS (15-4) OF REGISTER 0 ARE SET TO ZERO BY THIS INSTRUCTION.

2. SET THE CF EQUAL TO:
   A. ONE, IF REGISTER 0 IS ZERO.
   B. ZERO, IF REGISTER 0 IS NONZERO.

3. SET THE OP CODE FIL BIT EQUAL TO BIT 15 IN WORD 0 OF THE HOLD-GET AREA.

4. BRANCH TO THE RETURN ADDRESS WHICH IS STORED IN WORDS 0 AND 1 OF THE HOLD-GET AREA.

5. ADD 16 TO THE HOLD-GET COUNTER.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

   APPROXIMATE EXECUTION TIME 5.10 MICROSECONDS

BTSAG GET REGISTERS 2 THROUGH 15 AND BRANCH TO SAVED ADDRESS

1. LOAD REGISTERS 2 THROUGH 15 FROM WORDS 2 THROUGH 15 OF THE HOLD-GET AREA.

2. SET THE CF EQUAL TO:
   A. ONE, IF REGISTER 0 IS ZERO.
   B. ZERO, IF REGISTER 0 IS NONZERO.

3. SET THE OP CODE FIL BIT EQUAL TO BIT 15 IN WORD 0 OF THE HOLD-GET AREA.

4. BRANCH TO THE RETURN ADDRESS WHICH IS STORED IN WORDS 0 AND 1 OF THE HOLD-GET AREA.

5. ADD 16 TO THE HOLD-GET COUNTER.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

   APPROXIMATE EXECUTION TIME 31.20 MICROSECONDS

PTSAGN N GET REGISTERS, LOAD RETURN CODE, AND BRANCH TO SAVED ADDRESS

1. LOAD REGISTERS 2 THROUGH 15 FROM WORDS 2 THROUGH 15 OF THE HOLD-GET AREA.

2. LOAD THE RETURN CODE N INTO BITS (3-0) OF REGISTER 0.
   BITS (15-4) OF REGISTER 0 ARE SET TO ZERO BY THIS INSTRUCTION.

3. SET THE CF EQUAL TO:
   A. ONE, IF REGISTER 0 IS ZERO.
   B. ZERO, IF REGISTER 0 IS NONZERO.

4. SET THE CP CODE FIL BIT EQUAL TO BIT 15 IN WORD 0 OF THE HOLD-GET AREA.

5. BRANCH TO THE RETURN ADDRESS WHICH IS STORED IN WORDS 0 AND 1 OF THE HOLD-GET AREA.

6. ADD 16 TO THE HOLD-GET COUNTER.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

   APPROXIMATE EXECUTION TIME 31.35 MICROSECONDS

PTE PROGRAM INTERRUPT END

1. ZERO THE BLOCK INTERRUPT (BIN) BIT IN THE SYSTEM STATUS REGISTER WHICH WILL ENABLE INTERRUPTS.

2. RESTORE THE OP CODE FILL BIT WHICH WAS SAVED IN BIT 15 OF WORD 0 OF THE HOLD-GET AREA.

3. BRANCH TO THE RETURN ADDRESS WHICH IS STORED IN WORDS 0 AND 1 OF THE HOLD-GET AREA.

4. ADD 16 TO THE HOLD-GET COUNTER.

   APPROXIMATE EXECUTION TIME 4.20 MICROSECONDS

ARITHMETIC OPERATIONS

AP Rx,Ry ADD Ry TO Rx AND STORE THE RESULT IN Rx

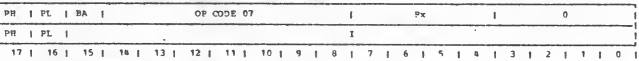
1. ADD THE CONTENTS OF Ry TO THE CONTENTS OF Rx AND PLACE THE RESULT IN Rx.

2. SET THE CF EQUAL TO:
   A. ONE, WHEN THIS INSTRUCTION CAUSES A CARRY BEYOND B(15).
   B. ZERO, WHEN THERE IS NO CARRY BEYOND B(15).

3. Ry IS UNCHANGED.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

AI Rx,I ADD 16 BITS OF IMMEDIATE DATA, I, TO Rx



1. ADD I TO THE CONTENTS OF Rx AND STORE THE RESULTS IN Rx.

2. SET THE CF EQUAL TO:
   A. ONE, WHEN THIS INSTRUCTION CAUSES A CARRY BEYOND B(15).
   B. ZERO, WHEN THERE IS NO CARRY BEYOND B(15).

   APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

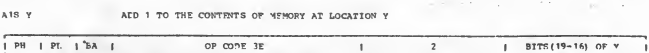
AN Rx,N ADD 8 BITS OF IMMEDIATE DATA, N, TO Rx

1. ADD N TO THE CONTENTS OF Rx AND STORE THE RESULTS IN Rx.

2. SET THE CF EQUAL TO:
   A. ONE, WHEN THIS INSTRUCTION CAUSES A CARRY BEYOND B(15).
   B. ZERO, WHEN THERE IS NO CARRY BEYOND B(15).

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

AIS Y ADD 1 TO THE CONTENTS OF MEMORY AT LOCATION Y



1. ADD 1 TO THE CONTENTS OF MEMORY AT LOCATION Y.

2. SET THE CF EQUAL TO:
   A. ONE, WHEN THIS INSTRUCTION CAUSES A CARRY BEYOND B(15).
   B. ZERO, WHEN THERE IS NO CARRY BEYOND B(15).

3. PLACE THE SUM IN MEMORY AT LOCATION Y.

   APPROXIMATE EXECUTION TIME 5.40 MICROSECONDS

SM Rx,N SUBTRACT 8 BITS OF IMMEDIATE DATA, N, FROM Rx

PH	PL	BA	OP CODE 08	Rx	2s COMPLEMENT OF N
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. SUBTRACT N FROM THE CONTENTS OF Rx AND STORE THE RESULT IN Rx.
   THE SUBTRACTION IS ACCOMPLISHED BY ADDING THE 2s COMPLEMENT OF N TO Rx.
   IF N IS EQUAL TO 0, 16 WILL BE SUBTRACTED FROM Rx.

2. SET THE CF EQUAL TO:
   A. ONE, WHEN Rx≥N IF N≠0.
   B. ZERO, WHEN Rx<N.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

SR Rx,Ry SUBTRACT Ry FROM Rx AND STORE THE RESULT IN Rx

PH	PL	BA	OP CODE 0A	Rx	Ry
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. SUBTRACT THE CONTENTS OF Ry FROM THE CONTENTS OF Rx AND STORE THE RESULT IN Rx.

2. SET THE CF EQUAL TO:
   A. ONE, WHEN Rx≥Ry.
   B. ZERO, WHEN Rx<Ry.

3. Ry IS UNCHANGED.

   APPROXIMATE EXECUTION TIME 1.35 MICROSECONDS

SI Rx,I SUBTRACT 16 BITS OF IMMEDIATE DATA, I, FROM Rx

PH	PL	BA	OP CODE 07	Rx	0
PH	PL	2s COMPLEMENT OF I			
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. SUBTRACT I FROM THE CONTENTS OF Rx AND STORE THE RESULT IN Rx.
   THE SUBTRACTION IS ACCOMPLISHED BY ADDING THE 2s COMPLEMENT OF I TO Rx.

2. SET THE CF EQUAL TO:
   A. ONE, WHEN Rx≥I IF I≠0.
   B. ZERO, WHEN Rx<I.

   APPROXIMATE EXECUTION TIME 2.80 MICROSECONDS

LOGIC OPERATIONS

COM Rx[,Ry] COMPLEMENT Rx[Ry] AND STORE IN Rx

PH	PL	BA	OP CODE 1A	Rx	Rx[Ry]
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. IF Ry IS NOT SPECIFIED, COMPLEMENT Rx AND STORE IN Rx.

2. IF Ry IS SPECIFIED, COMPLEMENT Ry AND STORE IN Rx.

3. IF Rx IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, CLEAR THE CF.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

NI Rx,I AND 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx

PH	PL	BA	OP CODE 07	Rx	2
PH	PL	I
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. AND 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx.

2. IF Rx IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, CLEAR THE CF.

   APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

NR Rx,Ry AND Ry TO Rx AND STORE IN Rx

PH	PL	BA	OP CODE 18	Rx	Ry
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. AND Ry TO Rx AND STORE THE RESULT IN Rx.

2. Ry IS UNCHANGED.

3. IF Rx IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, CLEAR THE CF.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

OI Rx,I INCLUSIVE OR 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx

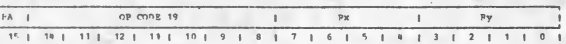
PH	PL	BA	OP CODE 07	Rx	3
PH	PL	I
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. INCLUSIVE OR 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx.

2. IF Rx IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, CLEAR THE CF.

   APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

XO Rx,Ry INCLUSIVE OR Ry TO Rx AND STORE IN Rx



1. INCLUSIVE OR Ry TO Rx AND STORE THE RESULT IN Rx.

2. Ry IS UNCHANGED.

3. IF Rx IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, CLEAR THE CF.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

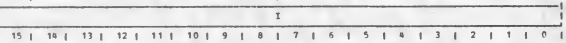
XI Rx,I EXCLUSIVE OR 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx

1. EXCLUSIVE OR 16 BITS OF IMMEDIATE DATA, I, TO Rx AND STORE IN Rx.

2. IF Rx IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, CLEAR THE CF.

   APPROXIMATE EXECUTION TIME 2.80 MICROSECONDS

XR Rx,Ry EXCLUSIVE OR Ry TO Rx AND STORE IN Rx



1. EXCLUSIVE OR Ry TO Rx AND STORE THE RESULT IN Rx.

2. Ry IS UNCHANGED.

3. IF Rx IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, CLEAR THE CF.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

CR Rx,Ry COMPARE Ry TO Rx

1. COMPARE Rx TO Ry BIT FOR BIT.

2. SET THE CF TO:
   A. ONE, IF ALL OF THE BITS MATCH.
   B. ZERO, IF ONE OR MORE OF THE BIT POSITIONS MISMATCH.

3. Rx AND Ry ARE NOT CHANGED BY THIS INSTRUCTION.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

CBW Rx,Ry,M COMPARE Ry TO Rx UNDER 16 BIT IMMEDIATE MASK

PH	PL	BA	OP CODE 1F	Rx	Ry
PH	PL		MASK		

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. COMPARE Rx TO Ry BIT FOR BIT FOR EVERY BIT IN THE MASK THAT IS ONE.

2. SET THE CF TO:
   A. ONE, IF ALL OF THE BITS COMPARED MATCH.
   B. ZERO, IF ONE OR MORE OF THE COMPARED BIT POSITIONS MISMATCH.

3. Rx AND Ry ARE NOT CHANGED BY THIS INSTRUCTION.

   APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

CI Rx,I COMPARE Rx TO 16-BITS OF IMMEDIATE DATA, I

PH	PL	BA	OP CODE 07	Rx	S
PH	PL		I		

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. COMPARE Rx TO I BIT FOR BIT.

2. SET THE CF TO:
   A. ONE, IF ALL OF THE BITS MATCH.
   B. ZERO, IF ONE OR MORE OF THE BIT POSITIONS MISMATCH.

3. Rx IS NOT CHANGED BY THIS INSTRUCTION.

   APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

CIRM Rx,I,N,M COMPARE 8 BITS OF Rx ROTATED BY N WITH IMMEDIATE DATA AND MASK

PH	PL	BA	OP CODE 1F	Rx	N
PH	PL		MASK	I	

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. COMPARE Rx TO I BIT FOR BIT FOR EVERY BIT IN THE MASK THAT IS ONE.

2. THE BITS IN Rx THAT ARE COMPARED ARE THE LOW 8 BITS AFTER THE CONTENTS OF Rx HAVE BEEN ROTATED RIGHT BY N.

3. SET THE CF TO:
   A. ONE, IF ALL OF THE BITS COMPARED MATCH.
   B. ZERO, IF ONE OR MORE OF THE COMPARED BIT POSITIONS MISMATCH.

4. Rx IS NOT CHANGED BY THIS INSTRUCTION.

   APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

RT Rx,Ry ROTATE Rx LEFT AN AMOUNT DETERMINED BY THE LOW 4 BITS OF Ry

PH	PL	BA	OP CODE 12	Rx	Ry

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. THE AMOUNT OF THE ROTATION, N, IS DETERMINED BY THE LOW 4 BITS OF Ry.

2. ROTATE Rx LEFT BY N BIT POSITIONS.

3. Ry IS UNCHANGED.

   APPROXIMATE EXECUTION TIME 2.70 MICROSECONDS

RLI Px,N ROTATE Px LEFT BY N BIT POSITIONS

PH	PI	BA	OP CODE 11	Px	16-N
17	16	15	14 | 13 | 12 | 11 | 10 | 9 | 8	7 | 6 | 5	4 | 3 | 2 | 1 | 0

1. ROTATE Px LEFT BY N BIT POSITIONS.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

RR Px,Py ROTATE Px RIGHT AN AMOUNT DETERMINED BY THE LOW 4 BITS OF Py

PH	PI	BA	OP CODE 13	Px	Py
17	16	15	14 | 13 | 12 | 11 | 10 | 9 | 8	7 | 6 | 5	4 | 3 | 2 | 1 | 0

1. THE AMOUNT OF THE ROTATION, N, IS DETERMINED BY THE LOW 4 BITS OF Ry.
2. ROTATE Px RIGHT BY N BIT POSITIONS.
3. Py IS UNCHANGED.

APPROXIMATE EXECUTION TIME 1.50 MICROSECONDS

RRI Px,N ROTATE Px RIGHT BY N BIT POSITIONS

PH	PI	BA	OP CODE 11	Px	N
17	16	15	14 | 13 | 12 | 11 | 10 | 9 | 8	7 | 6 | 5	4 | 3 | 2 | 1 | 0

1. ROTATE Px RIGHT BY N BIT POSITIONS.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TZ Rx TEST Px FOR ALL ZEROS

PH	PI	BA	OP CODE 18	Px	Px
17	16	15	14 | 13 | 12 | 11 | 10 | 9 | 8	7 | 6 | 5	4 | 3 | 2 | 1 | 0

1. IF Px IS EQUAL TO:
   A. ZERO, SET THE CF.
   B. NONZERO, ZERO THE CF.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

FLZ Px,Py FIND LOW ZERO IN Px AND RECORD ITS POSITION IN Ry

PH	PI	BA	OP CODE 21	Px	Py
17	16	15	14 | 13 | 12 | 11 | 10 | 9 | 8	7 | 6 | 5	4 | 3 | 2 | 1 | 0

1. LOOK THROUGH Px FOR THE FIRST ZERO FROM THE LOW END.
2. IF A ZERO IS FOUND:
   A. ITS LOCATION IS TRANSLATED TO A 4-BIT BINARY NUMBER WHICH IS PLACED INTO Py.
   B. BITS(15-4) OF Py ARE SET TO ZERO.
   C. THE CF IS SET TO 1.
   D. THE ZERO IN Px IS SET TO 1.
3. IF A ZERO IS NOT FOUND.
   A. THE CF IS SET TO 0.
   B. Py IS UNCHANGED.

NOTE: Px SHOULD NOT EQUAL Py

APPROXIMATE EXECUTION TIME 1.95 MICROSECONDS IF A ZERO IS FOUND AND 1.20 MICROSECONDS IF A ZERO IS NOT FOUND

SINGLE BIT OPERATIONS

SCF SET THE CONDITION-FLOP

1. SET THE CONDITION-FLOP.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

SOP SET OP CODE FIL BIT

1. SET OP CODE FIL BIT.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

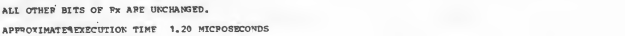
SBN Px,B SET BIT B IN Px

1. SET BIT B IN Px.

2. ALL OTHER BITS OF Px ARE UNCHANGED.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

SBR Rx,Ry SET BIT IN Px DETERMINED BY THE LOW 4 BITS OF Py



1. THE BIT POSITION B IS DETERMINED BY THE LOW 4 BITS OF Py.

2. SET BIT B IN Px.

3. ALL OTHER BITS OF Px ARE UNCHANGED.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

SPB N(PA),B SET BIT B IN MEMORY WORD AT LOCATION DETERMINED BY ADDING N TO PA

1. THIS INSTRUCTION OPERATES ON WORD WY AT LOCATION DETERMINED BY ADDING N TO PA.

2. SET BIT B IN WORD WY.

3. ALL OTHER BITS OF WY ARE UNCHANGED.

NOTE: BIT 8 IS DETERMINED BY THE VALUE OF PA. IT IS 0 FOR PA=12 AND 1 FOR PA=14.
SEE NOTE CONCERNING PA ON PAGE 82.

APPROXIMATE EXECUTION TIME 4.35 MICROSECONDS

ZCP . ZERO THE CONDITION-FLOP

PN	PL	BA	OP CODE 09	0	0
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. ZERO THE CONDITION-FLOP.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

ZBN Px,B ZERO BIT B IN Px

PN	PL	BA	OP CODE 28	Rx	B
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. ZERO BIT B IN Px.
2. ALL OTHER BITS OF Px ARE UNCHANGED.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

ZBP Px,Py ZERO BIT IN Px DETERMINED BY THE LOW 4 BITS OF Ry

PN	PL	BA	OP CODE 25	Rx	Ry
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. THE BIT POSITION B IS DETERMINED BY THE LOW 4 BITS OF Ry.
2. ZERO BIT B IN Px.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

ZBM N(RA),B ZERO BIT B IN MEMORY WORD AT LOCATION DETERMINED BY ADDING N TO RA

PN	PL	BA	CP CODES 64/65	B	N
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. THIS INSTRUCTION OPERATES ON WORD WY AT LOCATION DETERMINED BY ADDING N TO RA.
2. ZERO BIT B IN WORD WY.
3. ALL OTHER BITS OF WY ARE UNCHANGED.

NOTE: BIT 8 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
SEE NOTE CONCERNING RA ON PAGE B2.

APPROXIMATE EXECUTION TIME 8.35 MICROSECONDS

ZOP ZERO OP CODE FIL BIT

PN	PL	BA	OP CODE 0D	0	0
17	16	15	14 13 12 11 10 9 8	7 6 5 4	3 2 1 0

1. ZERO OP CODE FIL BIT.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

ICF Rx,N IMSERT CF IN BIT N OF Rx

PH	PL	PA	OP CODE 30	Rx	N
17	16	15	14 13 12 11 10	9 8 7 6 5	4 3 2 1 0

1. IF THE CF IS EQUAL TO:
   A. ZERO, ZERO BIT N OF Rx.
   B. ONE, SET BIT N OF Rx.

2. ALL OTHER BITS OF Rx ARE UNCHANGED.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TPPL Rx TEST GENERAL REGISTER PARITY LOW

PH	PL	BA	OP CODE 5E	0	Rx
17	16	15	14 13 12 11 10	9 8 7 6	5 4 3 2 1 0

1. SET THE CF EQUAL TO PL OF Rx. PL IS THE PARITY BIT FOR DATA BITS(7-0).

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TPPH Rx TEST GENERAL REGISTER PARITY HIGH

PH	PL	BA	OP CODE 5E	1	Rx
17	16	15	14 13 12 11 10	9 8 7 6	5 4 3 2 1 0

1. SET THE CF EQUAL TO PH OF Rx. PH IS THE PARITY BIT FOR DATA BITS(15-8).

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TSRPL Rs TEST SPECIAL REGISTER PARITY LOW

PH	PL	BA	OP CODE 5F	0	Rs
17	16	15	14 13 12 11 10	9 8 7 6	5 4 3 2 1 0

1. SET THE CF EQUAL TO PL OF Rs. PL IS THE PARITY BIT FOR DATA BITS(7-0).

   NOTE: IT IS NOT NECESSARY TO SUPPRESS THE GATING BUS PARITY CHECK WHEN USING THIS INSTRUCTION
   ON A SPECIAL REGISTER THAT MAY NOT HAVE CORRECT PARITY.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TSRPH Rs TEST SPECIAL REGISTER PARITY HIGH

PH	PL	BA	OP CODE 5F	1	Rs
17	16	15	14 13 12 11 10	9 8 7 6	5 4 3 2 1 0

1. SET THE CF EQUAL TO PH OF Rs. PH IS THE PARITY BIT FOR DATA BITS(15-8).

   NOTE: IT IS NOT NECESSARY TO SUPPRESS THE GATING BUS PARITY CHECK WHEN USING THIS INSTRUCTION
   ON A SPECIAL REGISTER THAT MAY NOT HAVE CORRECT PARITY.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TBM Px,B TEST BIT B IN Px

PN	PL	BA	OP CODE 28	Rx	B
17	16	15	14 13 12 11 10	9 8 7 6 5	4 3 2 1 0

1. SET THE CF EQUAL TO BIT B OF Px.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TBR Rx,Ry TEST BIT IN Px DETERMINED BY LOW 4 BITS OF Ry

PN	PL	BA	OP CODE 29	Rx	Ry
17	16	15	14 13 12 11 10	9 8 7 6 5	4 3 2 1 0

1. THE BIT POSITION B IS DETERMINED BY THE LOW 4 BITS OF Ry.

2. SET THE CF EQUAL TO BIT B OF Px.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TBS N(RA),B TEST BIT B IN MEMORY WORD AT LOCATION DETERMINED BY ADDING N TO RA

PN	PL	BA	OP CODES 52/53	B	N
17	16	15	14 13 12 11 10	9 8 7 6 5	4 3 2 1 0

1. THIS INSTRUCTION OPERATES ON WORD WY AT LOCATION DETERMINED BY ADDING N TO RA.

2. SET THE CF EQUAL TO BIT B IN WORD WY.

   NOTE: BIT B IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=14.
   SEE NOTE CONCERNING RA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 3.30 MICROSECONDS

TCC1 TEST CENTRAL CONTROL 1

PN	PL	BA	OP CODE 5F	1	F
17	16	15	14 13 12 11 10	9 8 7 6 5	4 3 2 1 0

1. SET THE CF EQUAL TO:
   A. ZERO, IF THIS INSTRUCTION IS EXECUTED IN CC 0.
   B. ONE, IF THIS INSTRUCTION IS EXECUTED IN CC 1.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

SIO SEND I/O MESSAGE OVER CHANNEL AND SUBCHANNEL DEFINED IN R9

| PH | PL | BA | OP CODE 27 | 0 | 0 |

| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

1. IDLE THE MAIN I/O CHANNEL DEFINED IN BITS(15-10) OF REGISTER 9.

2. LOAD THE I/O STATUS REGISTER WITH THE SUBCHANNEL SELECT FIELD DEFINED IN BITS(9-4) OF REGISTER 9 AND JAM THE TRANSMIT NORMAL CONTROL STATE.

3. LOAD THE I/O DATA REGISTER FROM REGISTER 10.

4. LOAD REGISTER 11 FROM THE I/O DATA REGISTER AND PERFORM A MATCH TEST.

5. INITIATE MESSAGE TRANSMISSION.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

SMIO SEND MAINTENANCE I/O MESSAGE OVER CHANNEL AND SUBCHANNEL DEFINED IN R9

| PH | PL | BA | OP CODE 27 | 2 | 0 |

| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

1. IDLE THE MAIN I/O CHANNEL DEFINED IN BITS(15-10) OF REGISTER 9.

2. LOAD THE I/O STATUS REGISTER WITH THE SUBCHANNEL SELECT FIELD DEFINED IN BITS(9-4) OF REGISTER 9 AND JAM THE TRANSMIT MAINTENANCE CONTROL STATE.

3. LOAD THE I/O DATA REGISTER FROM REGISTER 10.

4. LOAD REGISTER 11 FROM THE I/O DATA REGISTER AND PERFORM A MATCH TEST.

5. INITIATE MESSAGE TRANSMISSION.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TIO TEST FOR I/O MESSAGE IN CHANNEL DEFINED IN R9

| PH | PL | BA | OP CODE 27 | 4 | 0 |

| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

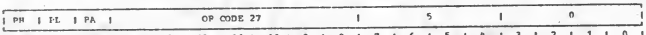
1. IF A MESSAGE IS PRESENT IN THE MAIN I/O CHANNEL DEFINED IN BITS(15-10) OF REGISTER 9:
   A. THE CF IS SET TO 1.
   B. REGISTER 11 IS LOADED WITH THE MESSAGE AND CHECKED FOR PARITY.
   C. THE MAIN CHANNEL IS PUT IN THE IDLE STATE.

2. IF A MESSAGE IS NOT PRESENT IN THE MAIN I/O CHANNEL DEFINED IN BITS(15-10) OF REGISTER 9:
   A. THE CF IS SET TO 0.
   B. REGISTER 11 IS UNCHANGED.

3. REGISTER 10 IS NOT CHANGED BY THIS INSTRUCTION.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

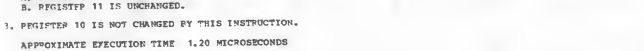
TMIO TEST FOR MAINTENANCE I/O MESSAGE IN CHANNEL DEFINED IN R9



1. IF A MAINTENANCE MESSAGE IS PRESENT IN THE MAIN I/O CHANNEL DEFINED IN BITS(15-10) OF REGISTER 9:
   A. THE CF IS SET TO 1.
   B. REGISTER 11 IS LOADED WITH THE MESSAGE AND CHECKED FOR PARITY.
   C. THE MAIN CHANNEL IS PUT IN THE IDLE STATE.
2. IF A MAINTENANCE MESSAGE IS NOT PRESENT IN THE MAIN I/O CHANNEL DEFINED IN BITS(15-10) OF REGISTER 9:
   A. THE CF IS SET TO 0.
   B. REGISTER 11 IS UNCHANGED.
3. REGISTER 10 IS NOT CHANGED BY THIS INSTRUCTION.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

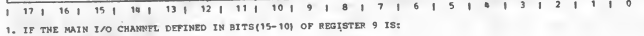
TCH TEST THE MAIN I/O CHANNEL DEFINED IN R9 FOR THE IDLE STATE



1. IF THE MAIN I/O CHANNEL DEFINED IN BITS(15-10) OF REGISTER 9 IS:
   A. IDLE, SET THE CF TO 1.
   B. NOT IDLE, SET THE CF TO 0.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

TIO IDLE THE MAIN I/O CHANNEL DEFINED IN R9

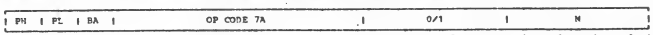


1. IDLE THE MAIN I/O CHANNEL DEFINED IN BITS (15-10) OF REGISTER 9.

   NOTE: BITS(9-8) OF REGISTER 9 MUST CONTAIN A 3-OUT-OF-6 CODE TO PREVENT AN I/O ERROR.

   APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

CONL N(PA) COMPLEMENT WRITE THE ON-LINE STORE AT LOCATION PA INDEXED BY N



1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING N TO PA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. READ THE ON-LINE STORE WITHOUT STORE ERROR CORRECTION OR PROCESSOR ERROR CORRECTION.

4. WRITE THE COMPLEMENT OF THE RECEIVED DATA INTO THE ON-LINE STORE.

5. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

6. ZERO THE CONDITION FLIP FLOP.

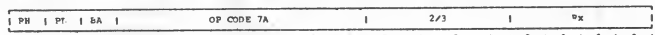
7. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
IF THE INSTRUCTION TIMES OUT,REGISTER 0 IS SET TO ALL ONES.

NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY,IT WILL BE SUPPLIED BY SYSTEM MACROS.
REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

NOTE: BIT 4 IS DETERMINED BY THE VALUE OF PA. IT IS 0 FOR PA=12 AND 1 FOR PA=14.
SEE NOTE CONCERNING PA ON PAGE B2.

APPROXIMATE EXECUTION TIME 9.90 MICROSECONDS.

CONLX Rx(PA) COMPLEMENT WRITE THE ON-LINE STORE AT LOCATION PA INDEXED BY Rx



1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING Rx TO PA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. READ THE ON-LINE STORE WITHOUT STORE ERROR CORRECTION OR PROCESSOR ERROR CORRECTION.

4. WRITE THE COMPLEMENT OF THE RECEIVED DATA INTO THE ON-LINE STORE.

5. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

6. ZERO THE CONDITION FLIP FLOP.

7. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
IF THE INSTRUCTION TIMES OUT,REGISTER 0 IS SET TO ALL ONES.

NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY,IT WILL BE SUPPLIED BY SYSTEM MACROS.
REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

NOTE: BIT 4 IS DETERMINED BY THE VALUE OF PA. IT IS 0 FOR PA=12 AND 1 FOR PA=14.
SEE NOTE CONCERNING PA ON PAGE B2.

APPROXIMATE EXECUTION TIME 9.75 MICROSECONDS.

COFL N(PA) COMPLEMENT WRITE THE OFF-LINE STORE AT LOCATION PA INDEXED BY N

PH	PL	BA	OP CODE 7B	0/1	N
17	16	15	14 13 12 11 10	9	8 7 6 5 4 3 2 1 0

1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING N TO RA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. READ THE OFF-LINE STORE WITHOUT STORE ERROR CORRECTION OR PROCESSOR ERROR CORRECTION.

4. WRITE THE COMPLEMENT OF THE RECEIVED DATA INTO THE OFF-LINE STORE.

5. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

6. ZERO THE CONDITION FLIP FLOP.

7. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
   IF THE INSTRUCTION TIMES OUT,REGISTER 0 IS SET TO ALL ONES.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY,IT WILL BE SUPPLIED BY SYSTEM MACROS.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-7+292.

   NOTE: BIT 4 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=13.
   SEE NOTE CONCERNING PA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 10.20 MICROSECONDS.

COFLX Rx(PA) COMPLEMENT WRITE THE OFF-LINE STORE AT LOCATION PA INDEXED BY Rx

PH	PL	BA	OP CODE 7B	2/3	Rx
17	16	15	14 13 12 11 10	9	8 7 6 5 4 3 2 1 0

1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING Rx TO RA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. READ THE OFF-LINE STORE WITHOUT STORE ERROR CORRECTION OR PROCESSOR ERROR CORRECTION.

4. WRITE THE COMPLEMENT OF THE RECEIVED DATA INTO THE OFF-LINE STORE.

5. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

6. ZERO THE CONDITION FLIP FLOP.

7. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
   IF THE INSTRUCTION TIMES OUT,REGISTER 0 IS SET TO ALL ONES.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY,IT WILL BE SUPPLIED BY SYSTEM MACROS.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-7+292.

   NOTE: BIT 4 IS DETERMINED BY THE VALUE OF RA. IT IS 0 FOR RA=12 AND 1 FOR RA=13.
   SEE NOTE CONCERNING RA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 10.05 MICROSECONDS.

MSTF N(PA) MAINTENANCE STORE FUNCTION USING REGISTER 0 AT LOCATION PA INDEXED BY N

PN	PL	PA	OP CODE 01	0/1	N
PN	PL	BEC0	CW0	BDSR1	BDSR0	ISO1	ISO0	UPD1	UPD0	IDL1	IDL0	RW1	RW0	MM21	MM20	MM11	MM10
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING N TO PA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. LOAD THE MAIN MEMORY STATUS REGISTER FROM THE SECOND WORD OF THIS INSTRUCTION.
   THE ISOLATE BITS ARE LEFT AS THEY WERE ON ENTRY.

4. PERFORM THE INDICATED READ/WRITE OPERATION USING REGISTER 0 AS DESTINATION/SOURCE FOR THE DATA.

5. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

6. ZERO THE CONDITION-FLOP.

7. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
   IF THE INSTRUCTION TIMES OUT, PROGSTEP 0 IS SET TO ALL ONES.

8. CAUTION: THE STORE OPERATION DEFINED BY THE MAIN MEMORY STATUS CONSTANT IN WORD 2 MAY ALLOW THIS INSTRUCTION TO GATE STORE DATA WITH BAD PARITY ONTO THE PROCESSOR GATING BUS. IF HARDWARE CHECKS ARE NOT INHIBITED THIS WILL CAUSE A PROCESSOR SWITCH.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY SYSTEM MACROS.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERS GUIDE X-74292.

   NOTE: BIT 8 IS DETERMINED BY THE VALUE OF PA. IT IS 0 FOR PA=12 AND 1 FOR PA=14.
   SEE NOTE CONCERNING PA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 7.20 MICROSECONDS

MSTFX Rx(PA) MAINTENANCE STORE FUNCTION USING REGISTER 0 AT LOCATION PA INDEXED BY Rx

PN	PL	PA	OP CODE 01	2/3	Rx
PN	PL	BEC0	CW0	BDSR1	BDSR0	ISO1	ISO0	UPD1	UPD0	IDL1	IDL0	RW1	RW0	MM21	MM20	MM11	MM10
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1. COMPUTE THE EFFECTIVE ADDRESS FOR THIS INSTRUCTION BY ADDING Rx TO PA.

2. SAVE THE CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

3. LOAD THE MAIN MEMORY STATUS REGISTER FROM THE SECOND WORD OF THIS INSTRUCTION.
   THE ISOLATE BITS ARE LEFT AS THEY WERE ON ENTRY.

4. PERFORM THE INDICATED READ/WRITE OPERATION USING REGISTER 0 AS DESTINATION/SOURCE FOR THE DATA.

5. RESTORE THE PREVIOUSLY SAVED CONTENTS OF THE MAIN MEMORY STATUS REGISTER.

6. ZERO THE CONDITION-FLOP.

7. THIS INSTRUCTION KEEPS AN INTERNAL TIMER TO PREVENT THE CC FROM HANGING.
   IF THE INSTRUCTION TIMES OUT, PROGSTEP 0 IS SET TO ALL ONES.

8. CAUTION: THE STORE OPERATION DEFINED BY THE MAIN MEMORY STATUS CONSTANT IN WORD 2 MAY ALLOW THIS INSTRUCTION TO GATE STORE DATA WITH BAD PARITY ONTO THE PROCESSOR GATING BUS. IF HARDWARE CHECKS ARE NOT INHIBITED THIS WILL CAUSE A PROCESSOR SWITCH.

   NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY SYSTEM MACROS.
   REFER TO 3ACC COMMON SYSTEM PROGRAMMERS GUIDE X-74292.

   NOTE: BIT 8 IS DETERMINED BY THE VALUE OF PA. IT IS 0 FOR PA=12 AND 1 FOR PA=14.
   SEE NOTE CONCERNING PA ON PAGE B2.

   APPROXIMATE EXECUTION TIME 7.05 MICROSECONDS

MI MICRO INTERPRET

1. SET INTERPRET MODE.
2. GATE X-FIELD TO THE MIR TO FIELD AND Y-FIELD TO THE MIR FROM FIELD.
3. PERFORM THE INDICATED MICRO OPERATION.
4. REPEAT FOR THE NEXT STORAGE WORD UNTIL MICRO OPERATION WHICH TURNS OFF INTERPRET MODE IS GIVEN.
5. INTERRUPTS ARE NOT PROCESSED WHEN THE CC IS IN INTERPRET MODE.

NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO. REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS PER MAIN MEMORY ACCESS

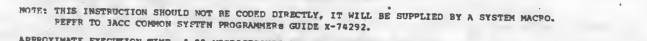
MIS SINGLE CYCLE MICRO INTERPRET

1. SET INTERPRET MODE.
2. GATE X-FIELD TO THE MIR TO FIELD AND Y-FIELD TO THE MIR FROM FIELD.
3. PERFORM THE INDICATED MICRO OPERATION.
4. CLEAR INTERPRET MODE AND EXECUTE THE NEXT SEQUENTIAL INSTRUCTION.
5. INTERRUPTS ARE NOT PROCESSED WHEN THE CC IS IN INTERPRET MODE.

NOTE: THIS INSTRUCTION SHOULD NOT BE CODED DIRECTLY, IT WILL BE SUPPLIED BY A SYSTEM MACRO. REFER TO 3ACC COMMON SYSTEM PROGRAMMERs GUIDE X-74292.

APPROXIMATE EXECUTION TIME 2.40 MICROSECONDS

NOP NO OPERATION



APPROXIMATE EXECUTION TIME 1.20 MICROSECONDS

HALT HALT THE CENTRAL CONTROL

1. THIS INSTRUCTION CAUSES THE CC TO LOOP UNTIL IT IS INITIALIZED OR INTERRUPTED. IF THE CC IS INTERRUPTED THE INTERRUPT WILL RETURN TO THE HALT INSTRUCTION.

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*  CAUTION: NO CHECK IS MADE TO DETERMINE THE ONLINE/OFFLINE STATUS  *
*           OF THE PROCESSOR PRIOR TO EXECUTION OF THIS INSTRUCTION  *
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